Stoller
Hanford Office

DOE-EM/GJ690-2004

299-E25-09 (A4797)
Log Data Report

Borehole Information:

Borehole: 299-E25-09 (A4797)			**Site:** 216-A-8 Crib		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 259.8		**GWL Date:** 06/28/04	
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
136,219.638 m	575,914.147 m	May 1956	201.448 m	288	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	+1.8	6 5/8	6 1/8	1/4	+1.8	228
Welded steel	0	unknown	unknown	unknown	0	288

The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated. The 8-in. casing is not visible at the ground surface. Surrounding the casing on top of the ground surface is a 2-ft by 6-in. round concrete pad.

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS[3], and Ledgerwood (1993). Zero reference is the top of the 6-in. casing. Before logging began the borehole was swabbed. No radioactivity was detected on the swab sample.

Logging Equipment Information:

Logging System:	Gamma 2A		**Type:** 35% HPGe (34TP20893A)
Calibration Date:	03/04	**Calibration Reference:**	DOE-EM/GJ642-2004
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5 / Repeat
Date	06/25/04	06/28/04	06/29/04	06/30/04	07/01/04
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	16.0	120.0	160.0	259.0	28.0
Finish Depth (ft)	3.0	15.0	119.0	159.0	3.0
Count Time (sec)	200	200	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A[4]	N/A	N/A	N/A	N/A

Log Run	1	2	3	4	5 / Repeat
Pre-Verification	BA353CAB	BA355CAB	BA356CAB	BA357CAB	BA358CAB
Start File	BA354000	BA355000	BA356000	BA357000	BA358000
Finish File	BA354013	BA355105	BA356042	BA357100	BA358025
Post-Verification	BA354CAA	BA355CAA	BA356CAA	BA357CAA	BA358CAA
Depth Return Error (in.)	0	0	0	- 1	0
Comments	No fine gain adjustment.	Fine gain adjustment after files: -016, -047, -062, -079, and -095.	No fine gain adjustment.	Fine gain adjustment after files: -068 and -087.	No fine gain adjustment.

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed without the centralizer on the sonde for spectral data collected on 06/30/04 (log run 4). Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 082. Maximum logging depth achieved was 259.0 ft, approximately 1 ft above groundwater.

Analysis Notes:

Analyst:	Henwood	Date:	07/07/04	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. All of the verification spectra were within the acceptance criteria.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G2AMAR04.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. Based on Ledgerwood (1993), the casing configuration was assumed to be a string of 6-in. casing with a thickness of 1/4 in. to a log depth of 228 ft and a string of 8-in. casing with a thickness of 0.322 in. to the depth of 288 ft. The 6-in. casing thickness was measured by the logging engineer. A casing thicknesss of 0.322 in. was assumed for the 8-in. casing. This thickness is the published value for ASTM schedule-40 steel pipe, a commonly used casing material at Hanford. Where more than one casing exists at a depth, the casing correction is additive (e.g., the correction for both 6-in. and 8-in. casing would be 0.25 + 0.322 = 0.572). Water and dead time corrections were not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected near the ground surface, at a few sporadic locations throughout the borehole, between 226 and 239 ft, and between 246 and 250 ft. The range of concentrations was from the MDL (0.2 pCi/g) to 13 pCi/g, which was measured at 5 ft. The ^{137}Cs detected at log depths between 226 and 232 ft is located at a depth interval consistent with the depth of a packer set at 228 ft. ^{137}Cs detected at 239 ft is approximately 20 ft above the current groundwater level. It is possible that a groundwater mound existed in the area in the past and the ^{137}Cs below 239 ft is a remnant of contaminated groundwater.

The KUT concentrations above 228 ft appear to be underestimated due to the effects of double casing and grout.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi, under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn. When radon is present, ^{214}Bi will tend to "plate" onto the casing wall and will quickly reach equilibrium with ^{222}Rn. Because the additional ^{214}Bi resulting from radon is on the inside of the casing, the effect of the casing correction is to amplify the 609 photopeak relative to the 1764 photopeak. (The magnitude of the casing correction factor decreases with increasing energy, but gamma rays originating inside the casing are not attenuated.) This effect is observed in the log data acquired for log run 2 between 15 and approximately 70 ft. The effects of radon appear to be minimal in the other log runs. The reason for variations in radon content between log runs on successive days is not known. Variations in radon content in boreholes are probably related to variations in surface weather conditions. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb.

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides (1461- and 2614-keV energy levels). The data for the 1764-keV energy peak indicate the effect of the radon between 15 and 28 ft where the original log run shows higher concentrations than the repeat data.

Gross gamma logs from Additon et al. (1977) (attached) indicate that the sediments surrounding this borehole contained significant amounts of man-made gamma radiation extending to groundwater from 1958 through at least 1963. By 1968 most of the gamma activity in the vadose zone had decayed away.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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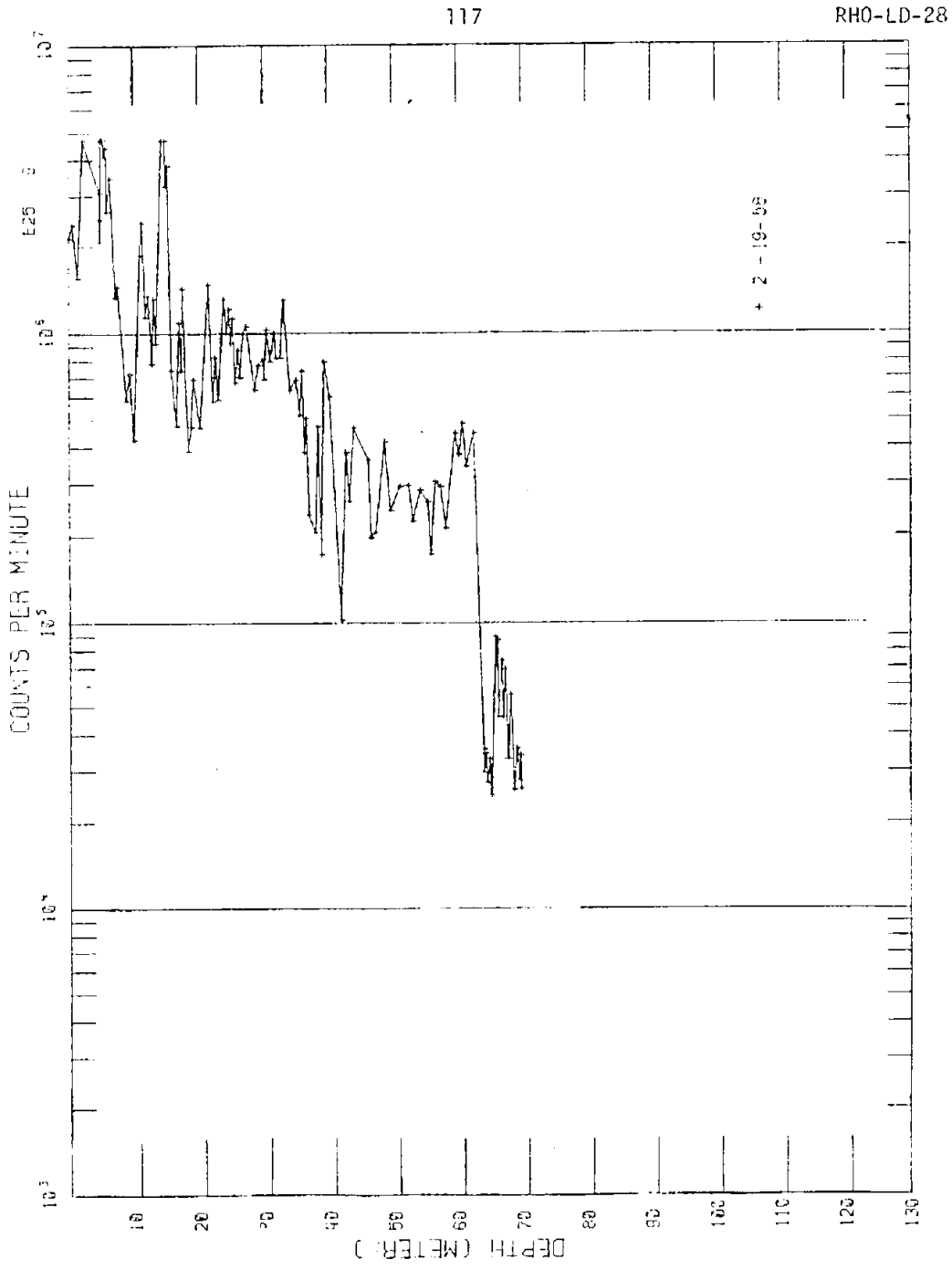
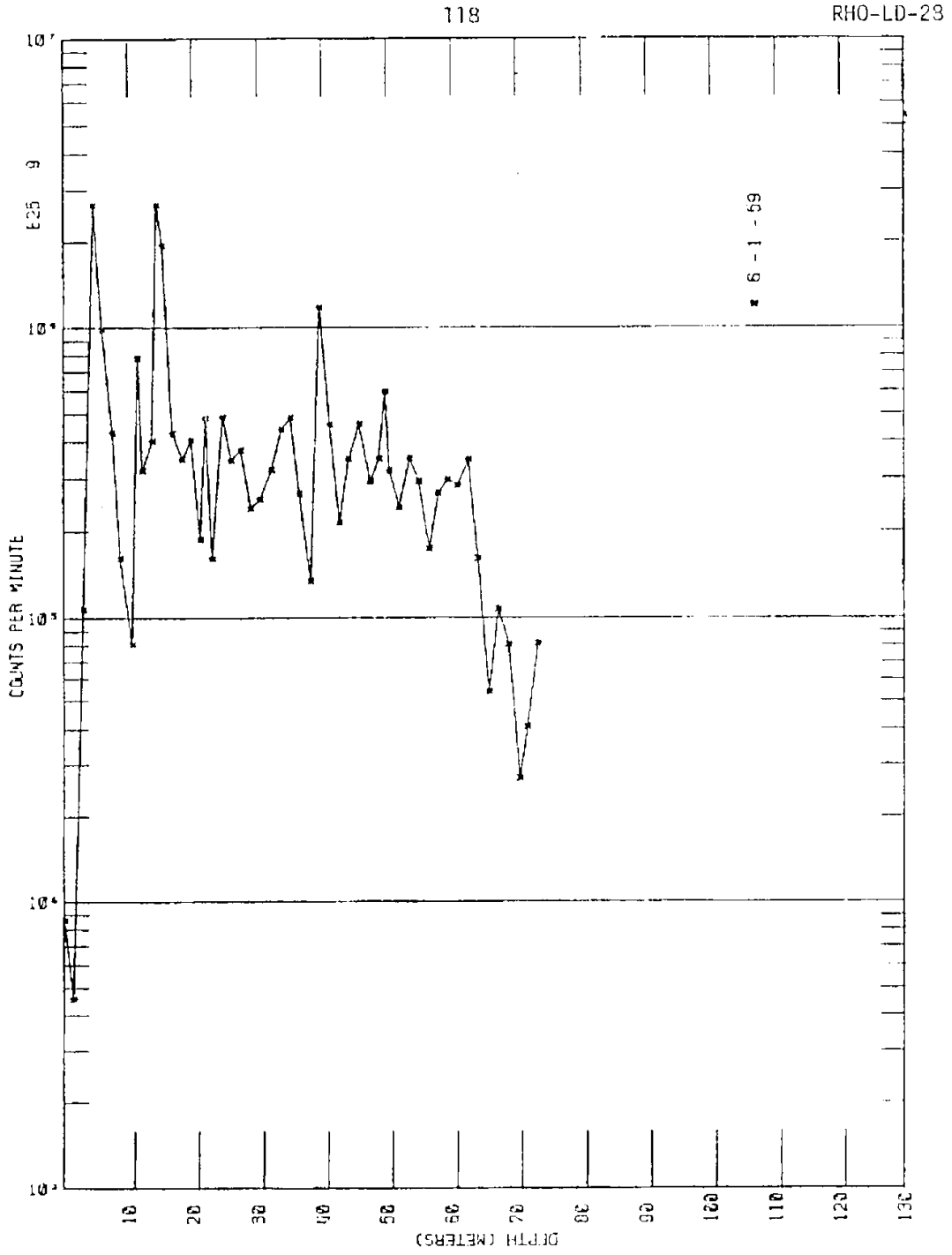
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



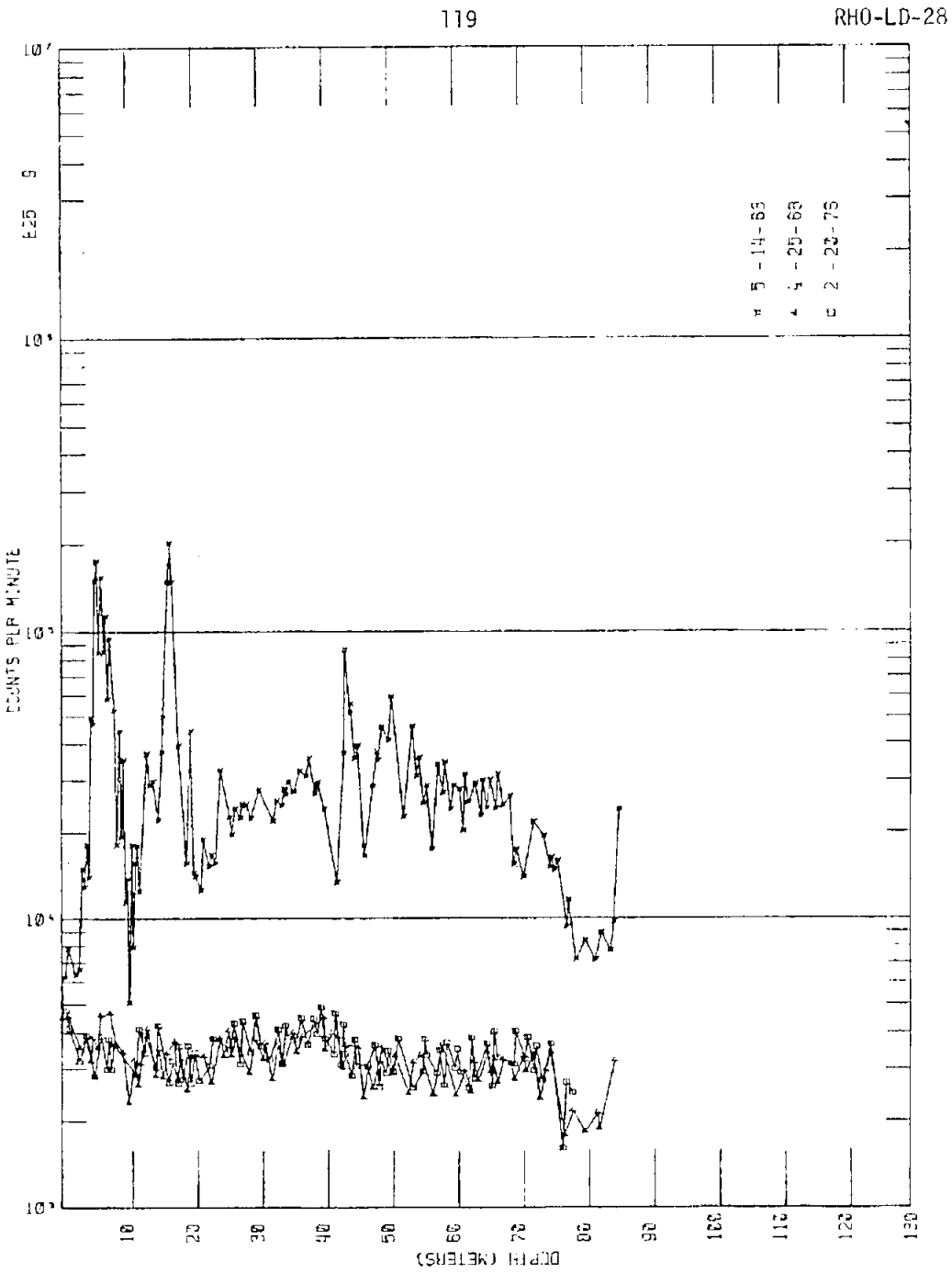
from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E25-9, Logged on 2/19/58



from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E25-9, Logged on 6/1/59

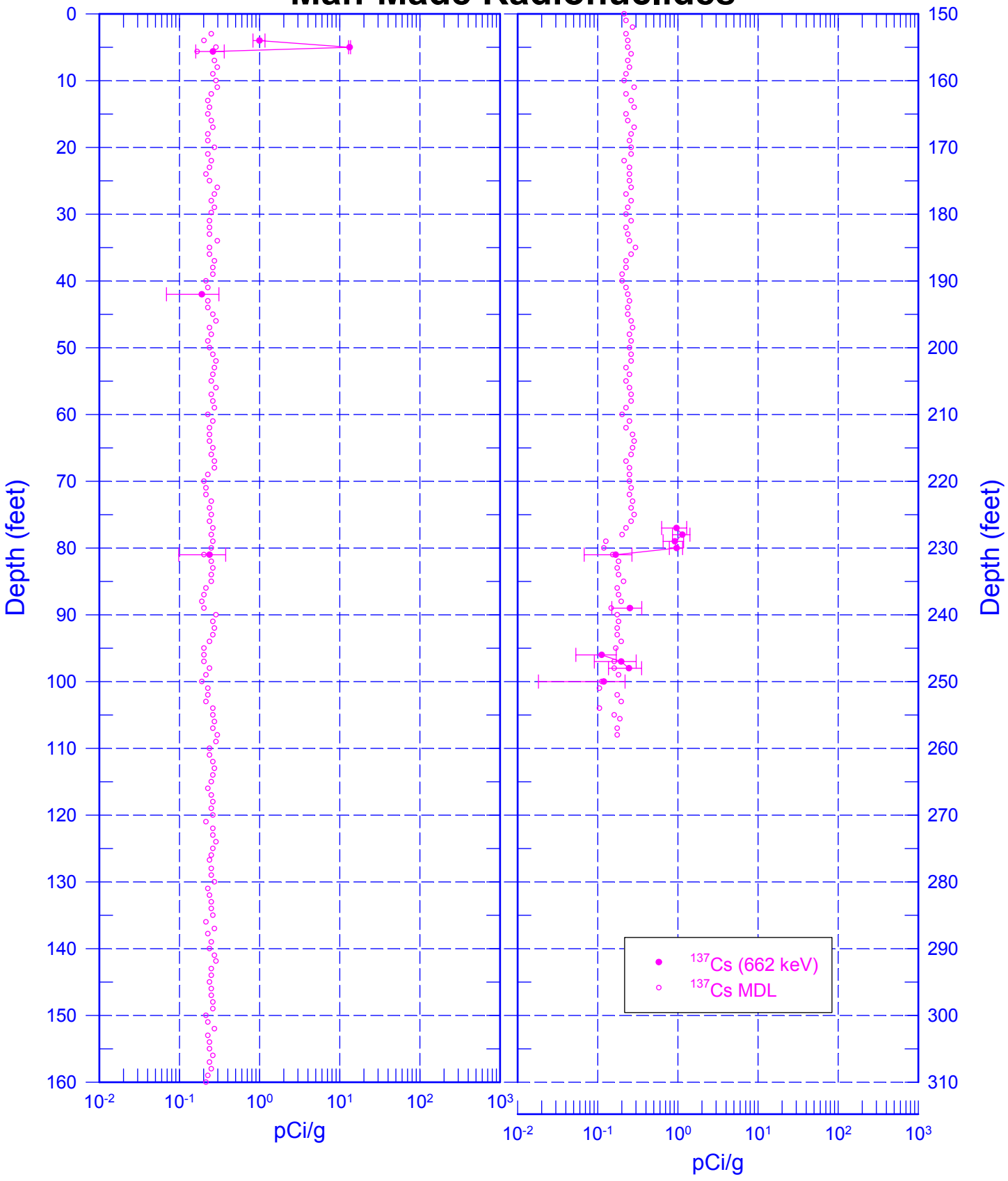


from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E25-9, Logged on 5/14/63, 4/25/68, and 2/20/76

299-E25-09 (A4797)

Man-Made Radionuclides

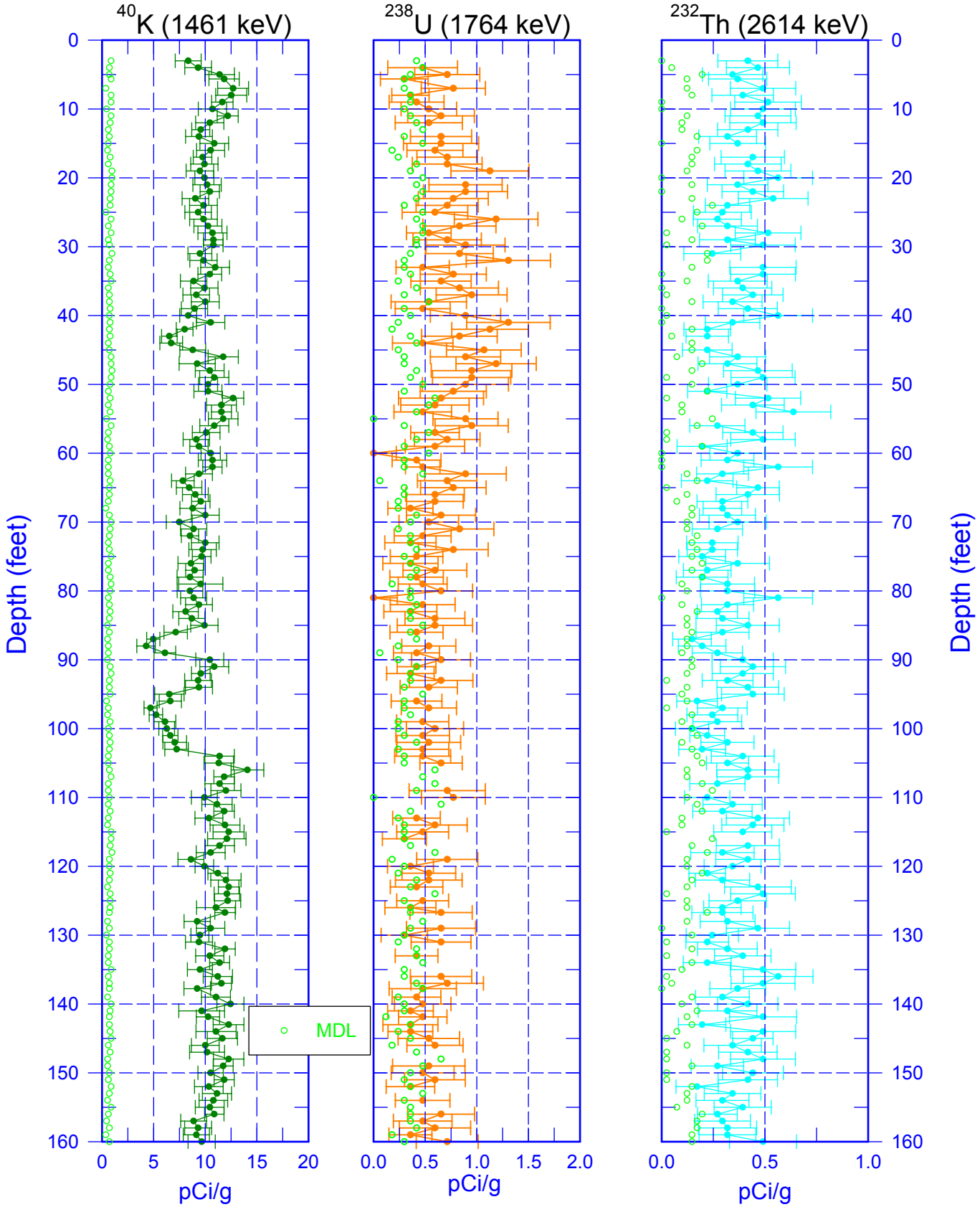


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 07/01/04

299-E25-09 (A4797)
Natural Gamma Logs

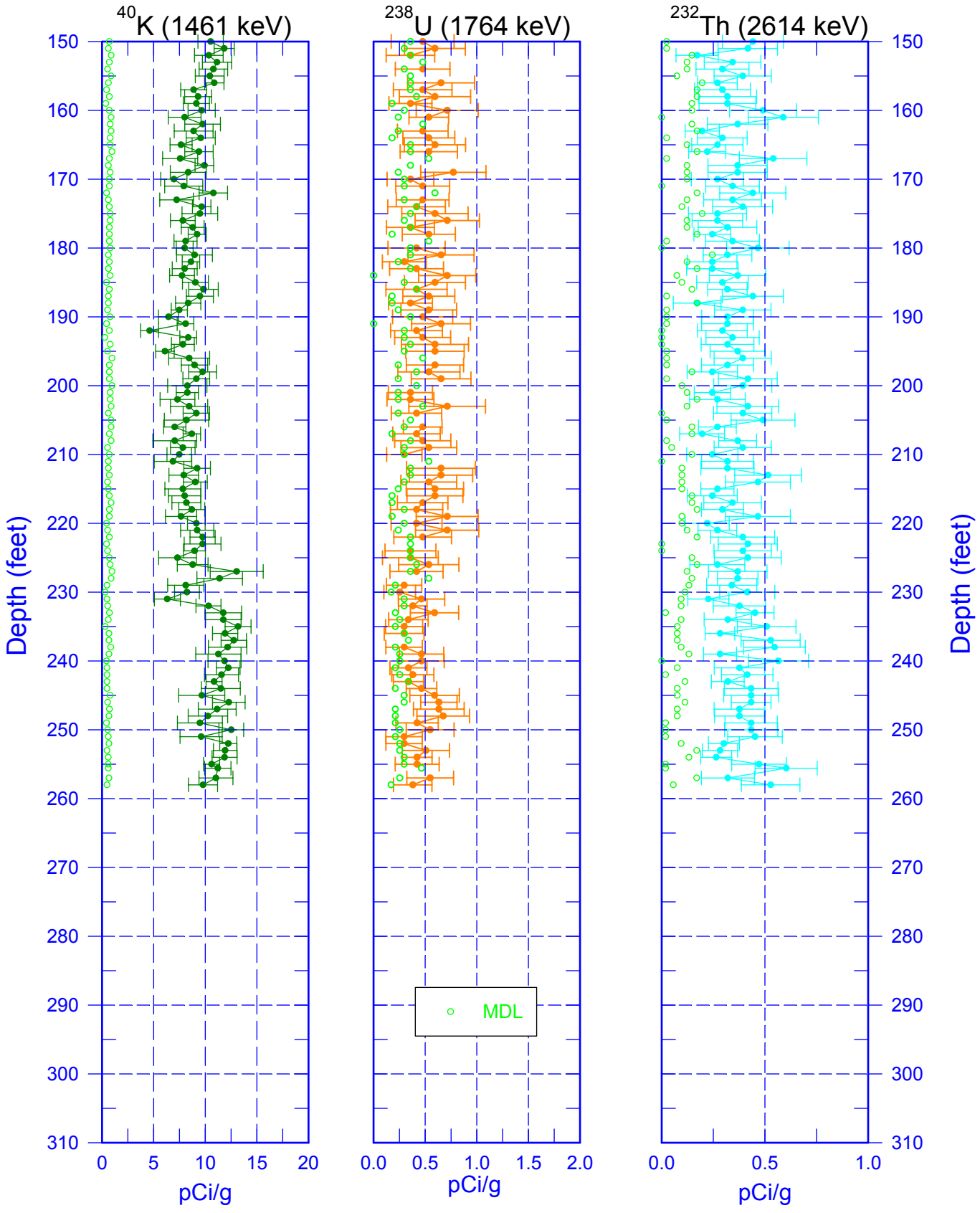


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 07/01/04

299-E25-09 (A4797)
Natural Gamma Logs

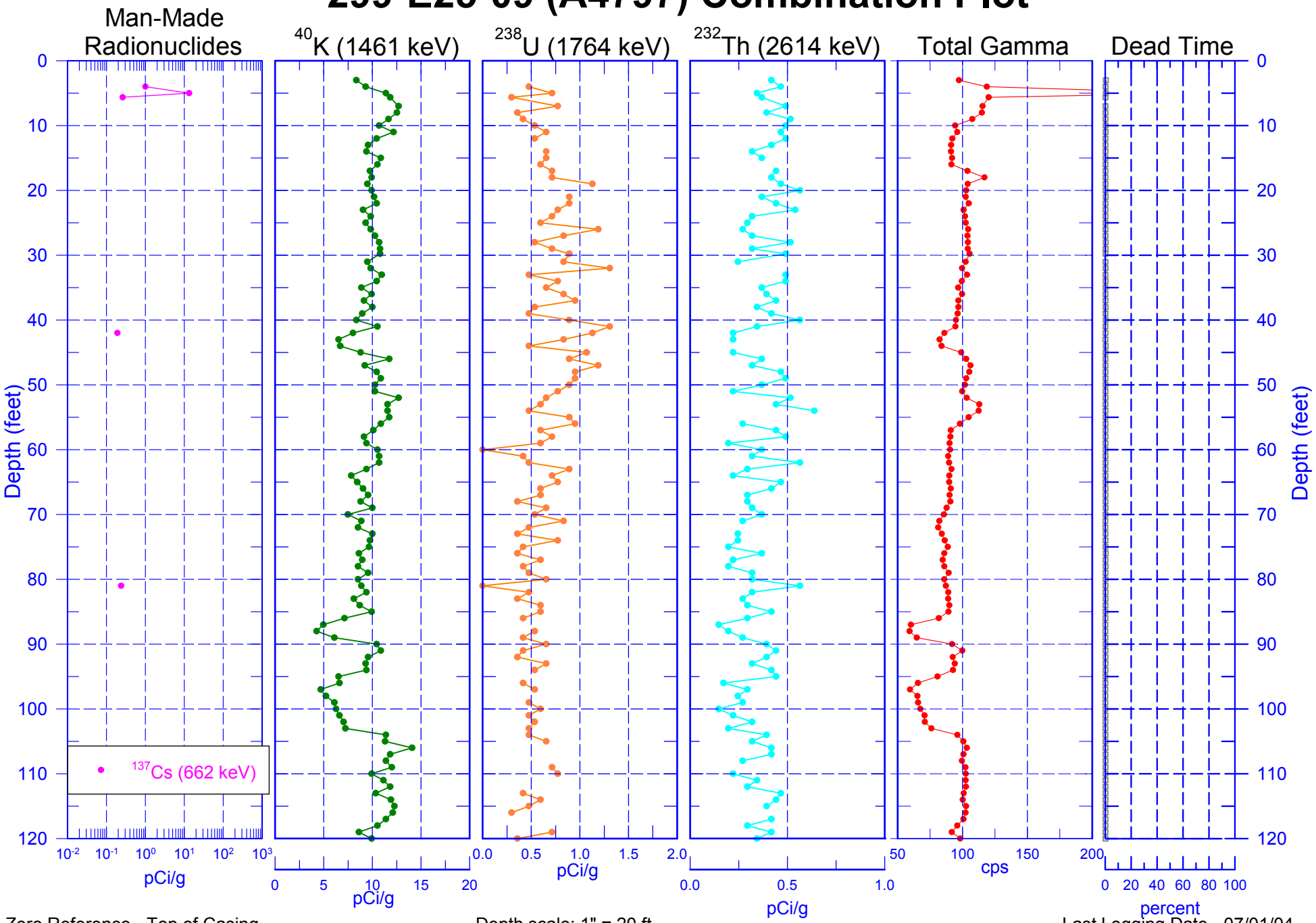


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 07/01/04

299-E25-09 (A4797) Combination Plot

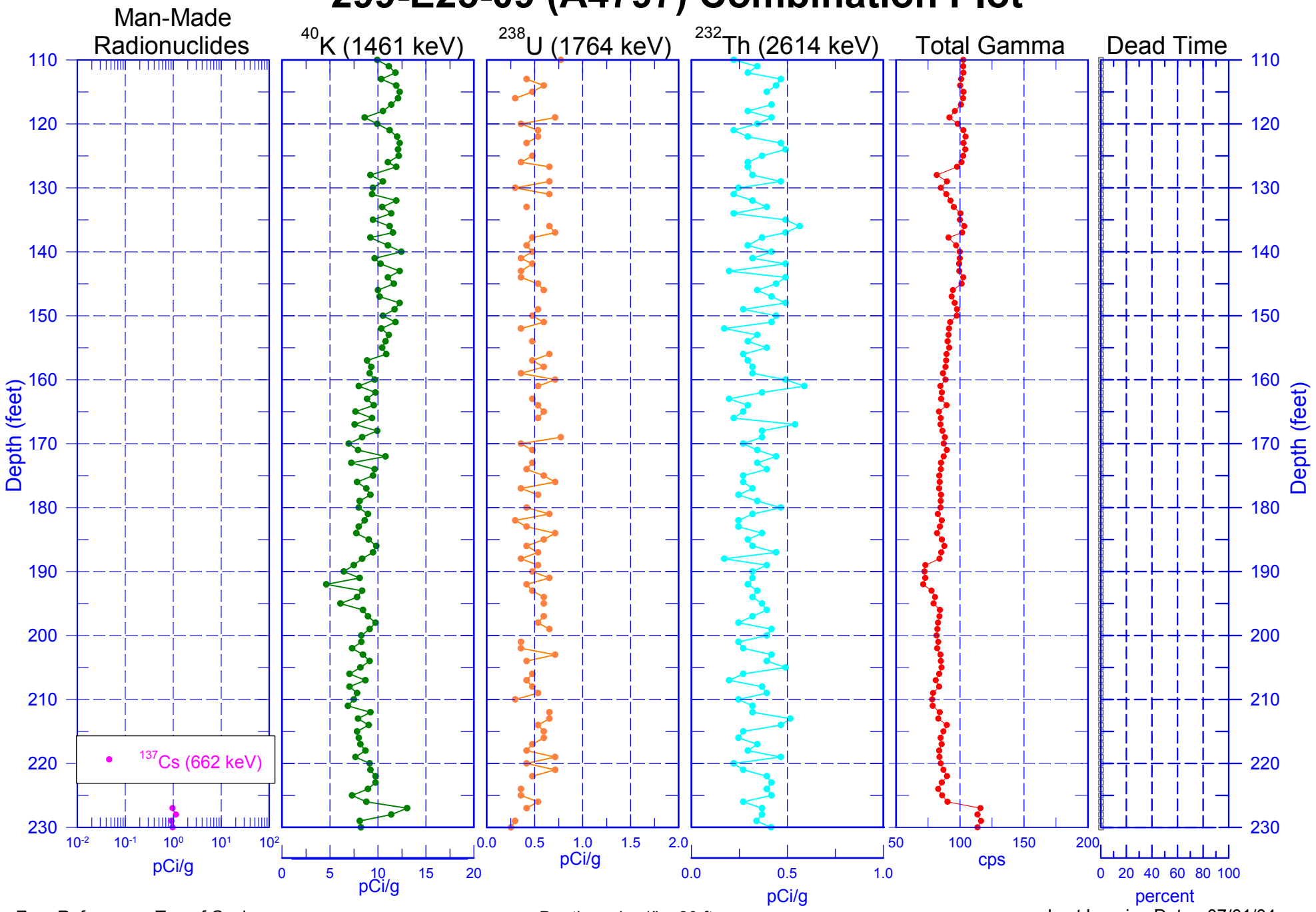


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Logging Date - 07/01/04

299-E25-09 (A4797) Combination Plot

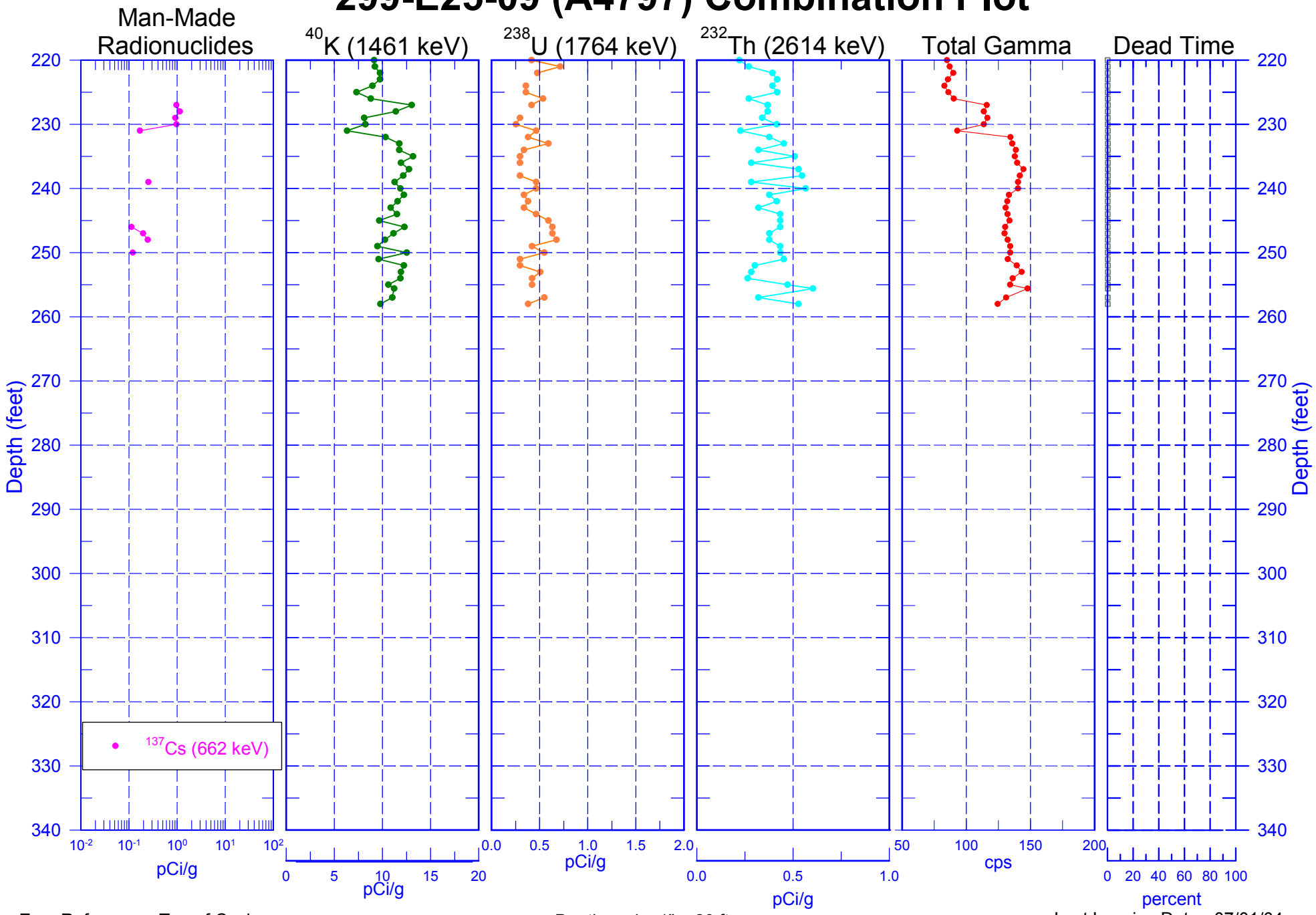


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Logging Date - 07/01/04

299-E25-09 (A4797) Combination Plot

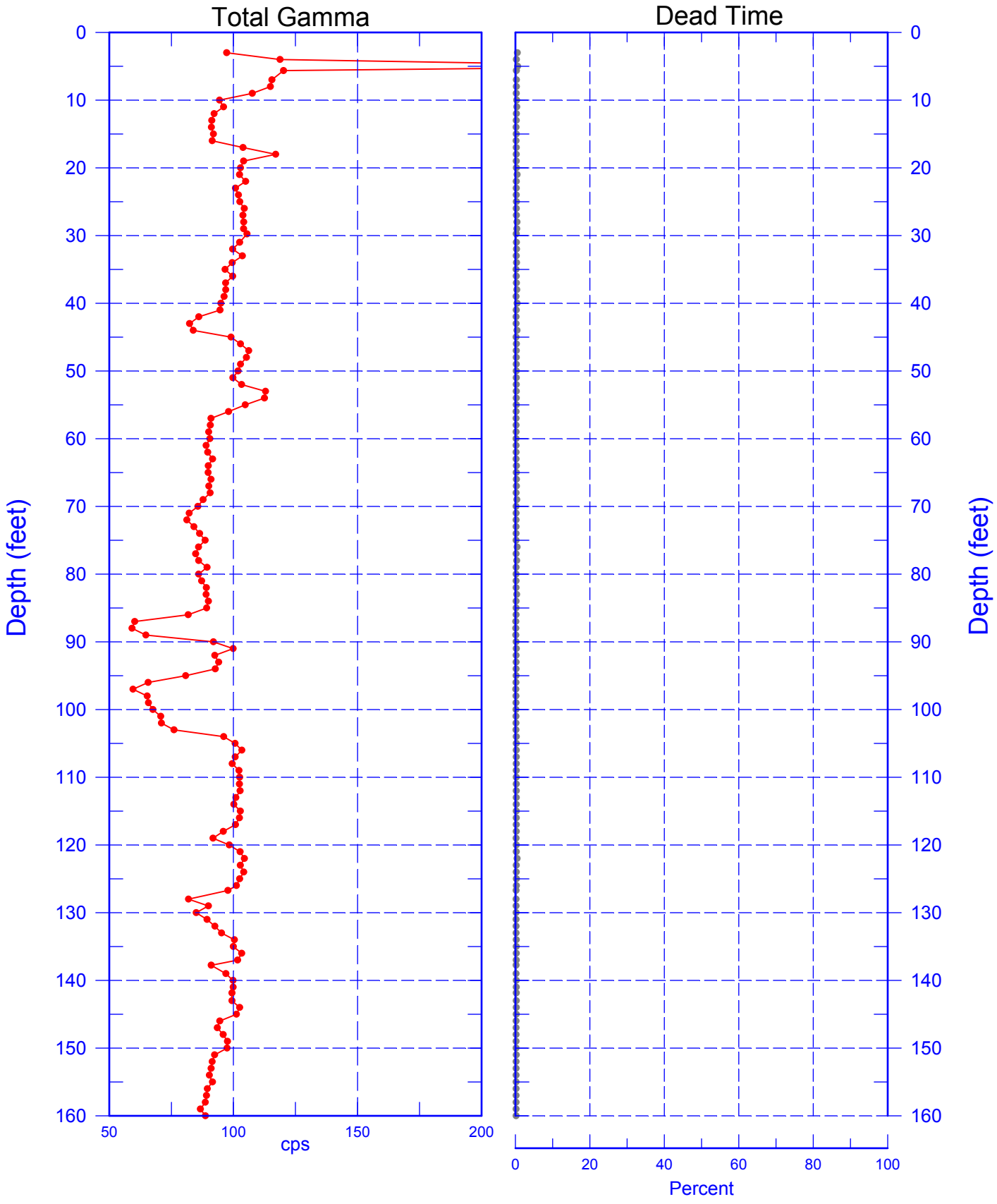


Zero Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Logging Date - 07/01/04

299-E25-09 (A4797)
Total Gamma & Dead Time

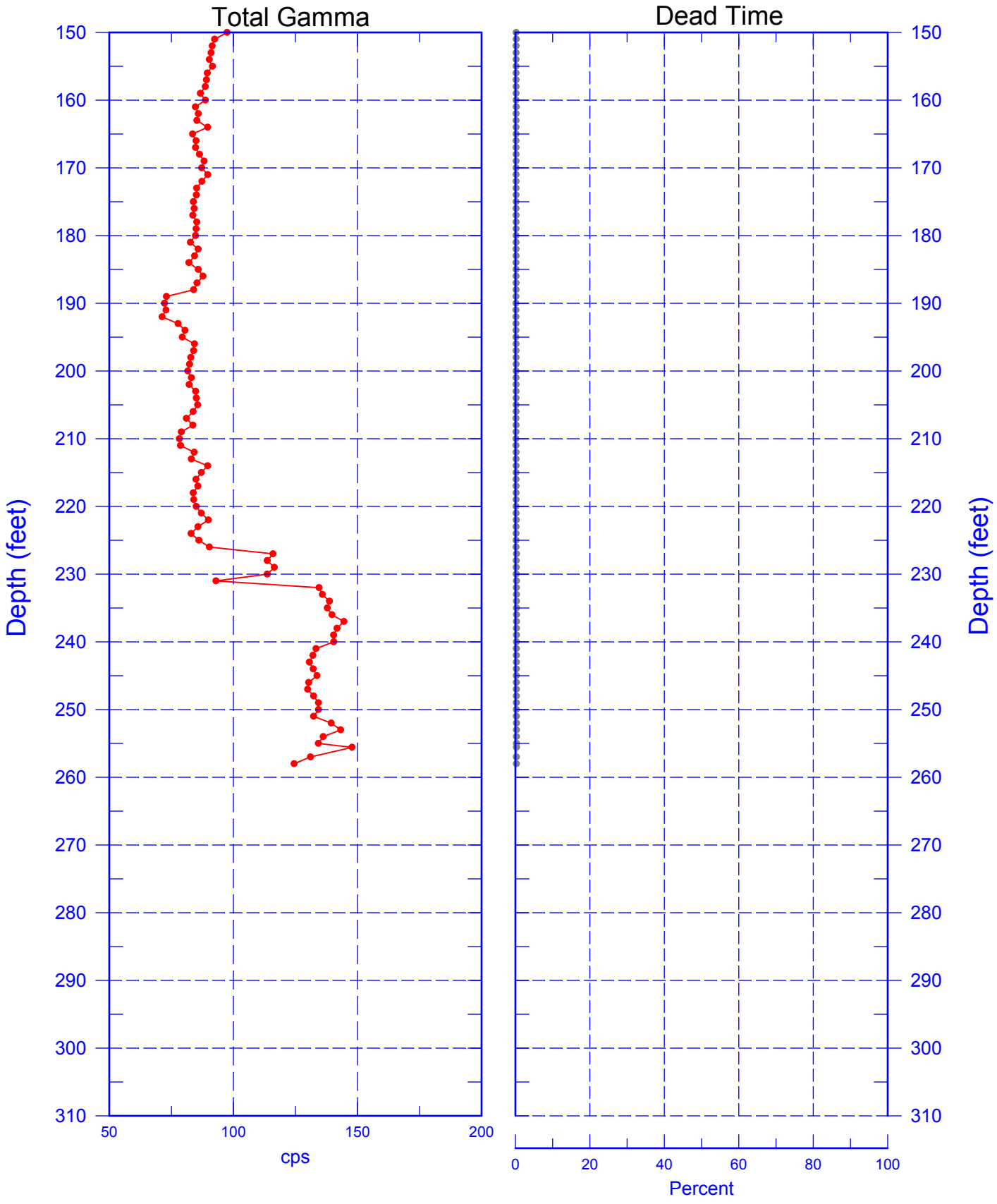


Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 07/01/04

299-E25-09 (A4797)
Total Gamma & Dead Time



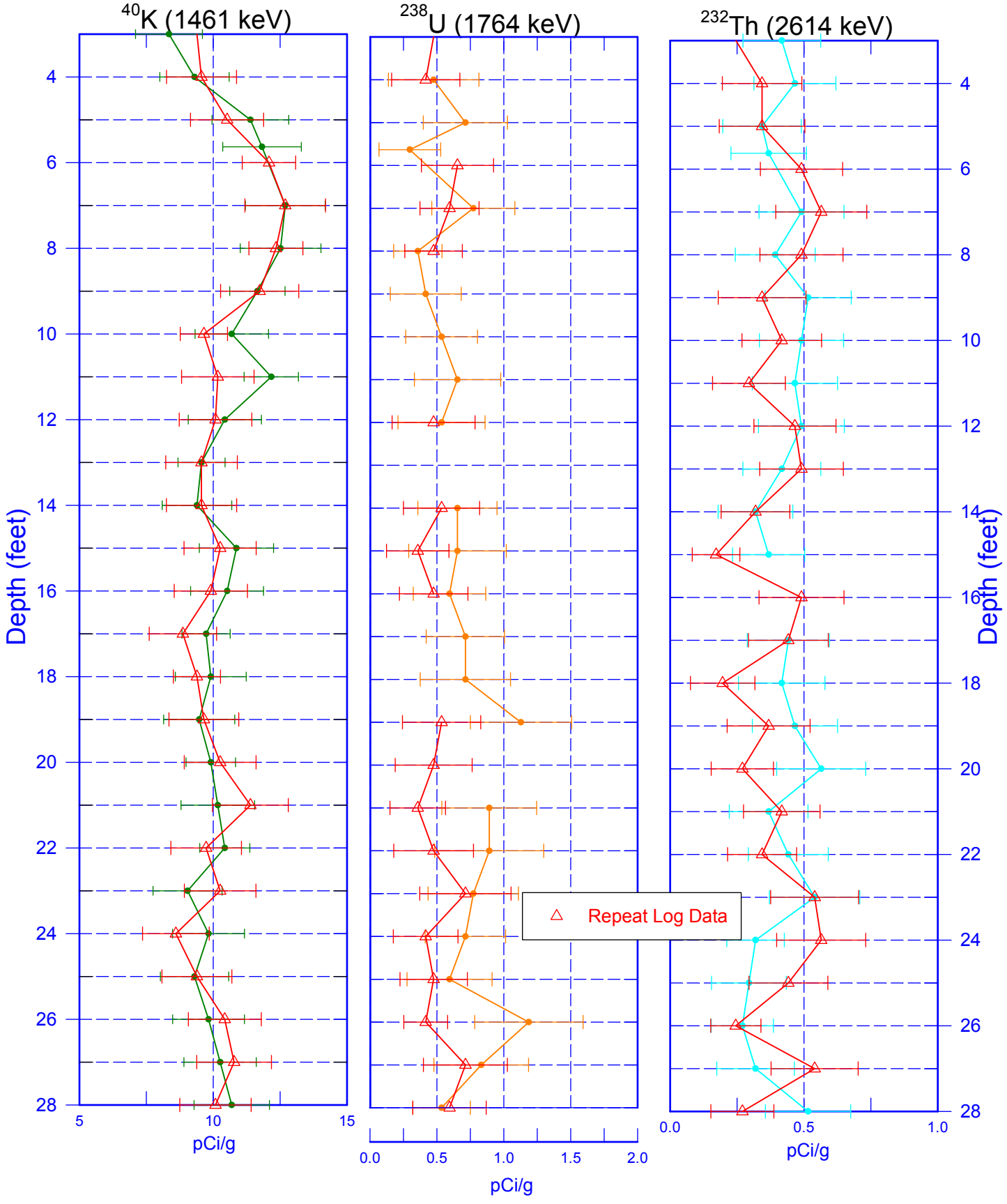
Reference - Top of Casing

Depth scale: 1" = 20 ft

Last Log Date - 07/01/04

299-E25-09 (A4797)

Repeat Section of Natural Gamma Logs



Zero Reference - Top of Casing

Last Log Date - 07/01/04